Novel insight from *Mnemiopsis* ecophysiological data using a coherent framework

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Periodic blooms of jellyfish or ctenophores have costly repercussions on human activities such as fisheries, industry and tourism. However, very little is known about its economic and environmental consequences. One way to tackle the problem is to implement realistic and dynamic properties of individuals into ecosystem models and study how gelatinous plankton respond to variable food supply, temperature and salinity. Hence, we first need to characterize the eco-physiological performance (respiration, excretion, reproduction and growth) of the individual and second to understand how the organism deals dynamically with stress factors such as starvation or low salinities. To complicate matters, gelatinous plankton are difficult to study in the field and the physiologies of many of the species are still poorly understood. In this study we propose to quantify dynamic properties of a 'model' for gelatinous plankton: the ctenophore *Mnemiopsis* spp., a notorious invader of European seas which can compete heavily with native zooplanktivores. We will perform the entire study within a coherent mass and energy balancing framework: Dynamic Energy Budget (DEB) theory. Our choice to use *Mnemiopsis* as a model is motivated by its high level of data completeness. On a scale of 0 to 10, *Mnemiopsis* has a data completeness level of 7 while most other gelatinous plankton have a low level of data completeness (around 2-3.5). This makes *Mnemiopsis* a great model organism to study the full dynamic mass and energy balance of an individual. Such an exercise is (i) the quantification of underlying processes (growth, maintenance etc.) under non stressed conditions, (ii) a test of the consistency between data sets and (iii) a formulation of explicit assumptions explaining the eventual inconsistencies.

Since the data completeness level is high, a good fit between a DEB model and data is strong support for the model and confirms the applicability of the theory. We obtained a good fit which opens up the route for the second part of this study: looking at the consequences of varying environmental parameters on the individual's eco-physiological performance via scenario analysis. This is done by analyzing how starvation and differences in ambient salinity regimes impacts the metabolism. To this end we incorporated a starvation and a salinity module into the core DEB model and fitted the DEB model to starvation and salinity data. We will complete the talk with a discussion of novel insights gained from parameterizing the DEB model to 53 data sets simultaneously in order to characterize the metabolism of an unstressed individual throughout its life. We will further propose several hypotheses which explain how an individual under (food and/or salinity) stress manages to pay its somatic maintenance in combination with continued reproduction. A long term application of these results is the implementation of the individual based DEB model into ecosystem models in order to predict the magnitude and timing of *Mnemiopsis* blooms as well as its geographical distribution in European waters.